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The Effects of Greed and Fear in Symmetric and Asymmetric Volunteer's Dilemmas

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Abstract

The current research explores the role of two different motives underlying volunteering (or defecting) in a simple economic game. We find in Study 1 that in a symmetric Volunteer's Dilemma (VoD) the willingness to volunteer is reduced more strongly by an increase in the payoff for unilateral defection (suggesting more greed) than by an increase in the payoff for mutual defection (suggesting less fear). In Study 2, we replicate this finding when only the participants' own payoffs are varied, but not when only the other player's payoffs are varied. These findings are inconsistent with standard (i.e., Nash) game-theoretic predictions and Schelling's focal-point hypothesis. Instead, the empirical patterns suggest that participants approach the VoD using egocentric decision heuristics.

Keywords: Volunteer's Dilemma, mixed motives, game theory, egocentrism

Introduction

Whether it is to clear the driveway after a bomb cyclone or to call the police after witnessing a murder on the street, a society is rife with great and small problems that await someone to step up and take action. In facing these problems, how do people make a decision of whether to volunteer or not? Game theorists use experimental games to study interpersonal dilemmas. In the Volunteer's Dilemma (VoD) (Diekmann, 1985), participants choose between volunteering and defecting in light of a payoff matrix showing the outcomes resulting from all possible combinations of choices made by the players (Figure 1).

		Player 2	
		Option A	Option B
Player 1	Option A	R | R	R | T
	Option B	T | R	P | P

Figure 1. The payoff matrix for the VoD game (Option A = Volunteer, Option B = Defect).

Using Rapoport's (1967) notation, the choice to volunteer (i.e., Option A) yields payoff R (for "Reward") irrespective of the other player's choice. The payoff for defecting (i.e., Option B) depends on the other player's choice. If the other player volunteers, the participant earns payoff T (for "Temptation"), but if the other player defects, the payoff is P (for "Penalty"). In the VoD, the payoffs are ranked such that T > R > P. Classic and psychological game theory predicts that the decision to accept the payoff R by volunteering is susceptible to the differences T – R and R – P. Following Coombs (1973), Dawes et al. (1986) used the terms "greed" and "fear" respectively to refer to the desire to maximize personal profit (i.e., T – R) and the desire to minimize personal loss (i.e., R – P). Research in public goods games and other variants of the prisoner's dilemma – where defection is the dominating strategy – has shown that increases in the greed parameter have a stronger negative effect on cooperation than do reductions in the fear parameter (Poppe & Utens, 1986; Rapoport & Eshed-Levy, 1989; Yamagishi & Sato, 1986). The question that arises is whether the same difference holds in the VoD.

Whereas, in public-goods dilemmas, a reduction of fear refers to having a less negative outcome in case of one's unilateral cooperation, a reduction of fear in the VoD refers to having a less negative outcome in case of mutual defection. It remains to be seen if the difference between the greed and the fear effect is the same in the mixed-motive VoD than it is in the defection-dominated public-goods or prisoner's dilemma games. For the present research, we therefore modified the VoD by either increasing the payoff T (i.e., more greed) or by increasing the payoff P (i.e., less fear) relative to a baseline game. In Study 1, these changes were effectuated for both players at the same time, whereas they were separately done for the self or the other in Study 2.

In Study 1, we assessed the willingness to volunteer in a baseline condition, in a more-greed condition, and in a less-fear condition of a two-person VoD with symmetrical payoffs. Game theory provides the Nash-equilibrium probability of volunteering which renders the other player indifferent in the sense that their expected value of volunteering is equal to the expected value of defecting.

This theoretical benchmark is given by P(V) = (R-P)/(T-P). With this, it is possible to generate payoff matrices that are game-theoretically equivalent (i.e., yield the same P(V)), but affect volunteering either through increases in the T payoff (i.e., more greed) or through increases in the P payoff (i.e., less fear). In this case, the Nash hypothesis predicts that volunteering decreases in the more-greed and the less-fear conditions by the same amount compared to the baseline condition.

Alternatively, the greed-dominance hypothesis predicts that increases in the T payoff (for unilateral defection) reduce volunteering more strongly than a game-theoretically equivalent increase in the P payoff (for mutual defection). This hypothesis is primarily based on empirical findings in the public-goods game and its variants (e.g., Dawes et al., 1986). Its psychological interpretation is rather *ad hoc*.

In Study 2, we expanded this investigation by varying either the payoffs available to the participating player or the payoffs available to the presumed opponent or partner. This extension was motivated by both theoretical and real-life considerations. In many real-life VoD situations, the cost of volunteering (i.e., T – R) may often be assessed in the context of total wealth, suggesting an understanding among players that the person who stands to gain the most from defecting be allowed to realize the gain of payoff T. Drawing on Schelling's (1960) seminal analysis (see also Harsanyi-Selten, 1988), Diekmann (1993; Przepiorka & Diekmann, 2013) studied VoDs with asymmetric payoffs. When payoff R was varied for one player, the player with a smaller difference T – R was considered "stronger" and found to volunteer more often than a comparatively weak player. Specifically, Diekmann (1993) suggested the ratio T/(T-R) as an index of strength. This "strength" hypothesis predicts differences among conditions opposite to the ones predicted by classic game theory (see below). Diekmann's (1993) data provided first evidence for the strength hypothesis. Varying only the R payoff, Diekmann's (1993) design confounded the effects of increased greed and reduced fear. The design of our Study 2 separates these motives.

The design of Study 2 permitted a test of a third hypothesis, egocentrism, which states that people approach interpersonal dilemmas by first focusing on what they themselves stand to gain or lose. Research on the trust dilemma shows that participants selectively attend to and weight self-relevant information when deciding between the uncertainty of trust and the certainty of a small gain obtained from distrust (Evans & Krueger, 2011). Recent research has uncovered the use of similar egocentric heuristics in the VoD (Krueger, Heck, Wagner, in press). In this initial work, only the difference T – R (i.e., greed) was varied. This variation affected volunteering when it occurred for the participant's own payoffs, but not when it occurred for the other person's payoffs. Despite having full access to the information about the other player's payoffs, people were inclined to make volunteering decisions in an egocentric manner.

We have reviewed three theoretical approaches to decision-making in the VoD (Nash equilibrium, player's relative "strength," and heuristic egocentrism). The final goal of Study 2 was to test – and potentially replicate – the greed-dominance hypothesis (Dawes et al., 1986). We predicted that, while being indifferent to the other player's payoff changes, people would be least willing to volunteer when their own T payoff rose.

Study 1

The goal of Study 1 was to explore the effects of reduced fear (smaller R – P) and increased greed (larger T – R) on volunteering in the VoD. We presented participants with three different VoD games — a baseline game and two variants, one with a raised T payoff and another with a raised P payoff. Participants reported how much they were inclined to choose one of the two options. According to the Nash hypothesis, there would be less willingness to volunteer in the two modified conditions, compared to the baseline condition, with no difference between the two (because the payoffs in these two conditions were arranged to yield the same Nash equilibrium probability). According to the greed-dominance hypothesis, however, willingness to volunteer should be lower when T rather than when P increased. Table 1 shows a schematic diagram of the predicted results in directional terms.

Table 1. Predicted results in Study 1.

	The Likelihood of Volunteering
Nash	Baseline > Less fear = More greed
Greed-Dominance	Baseline > Less fear > More greed

Method

Participants Participants (N = 392) were recruited on Amazon Mechanical Turk (MTurk) for a flat payment of $1 each. Such modest payments do not appear to threaten the validity of the findings in experimental games (Amir, Rand, & Kobi Gal, 2012; Krueger et al., in press). One participant did not complete the study and 74 failed to pass all 3 comprehension check questions. We analyzed the responses of the remaining 317 participants (N_{male} = 180, N_{female} = 136, N_{other} = 1, M_{age} = 34.66, SD_{age} = 10.29). Study 1 had a one-way (3 Game Type: baseline vs. more greed vs. less fear) within-subjects design.

Materials All participants responded to the three versions of the VoD game: baseline, more greed, and less fear (Figure 2). The more-greed game comprised a T payoff that was $10 higher for each player than it was in the baseline condition. The less-fear game comprised a P payoff that was increased by $5 for each player. This way, according to the Nash mixed-strategy equilibrium, the probability of volunteering was the same in the more-greed and less-fear conditions, P(V) = 0.33, while being smaller than that of the baseline condition, P(V) = 0.50.

		Baseline		More Greed		Less Fear	
		Player 2		Player 2		Player 2	
		Option A	Option B	Option A	Option B	Option A	Option B
Player 1	Option A	$20 | $20	$20 | $30	$20 | $20	$20 | $40	$20 | $20	$20 | $30
Player 1	Option B	$30 | $20	$10 | $10	$40 | $20	$10 | $10	$30 | $20	$15 | $15

Figure 2. Study 1. Symmetric VoD games (Player 1 = Participants).

Procedure After completing a separate study on self-enhancement, participants were informed that they would play 3 different games with another person. In playing the 3 different games, they were asked to make their decisions for each game independent from the other games. All participants were first presented with the baseline game, and the order of the more-greed game and the less-fear game was counterbalanced. After reviewing the payoff matrix, participants indicated their preference on a bipolar 8-point rating scale of *Very likely to choose Option A* (1) - *A bit likely to choose Option A* (4) - *A bit likely to choose Option B* (5) - *Very likely to choose Option B* (8). Next, they answered a comprehension check question, which asked them to choose the most likely final outcomes (payoffs) from the 4 possible outcomes based on their decisions. At the end of the study, they answered demographic questions about their age, gender, and so on.

Results and Discussion

So that higher ratings reflect higher likelihoods of choosing Option A (Volunteer), we reverse-coded respondents' ratings by subtracting them from 9. We then performed a one-way within-subjects analysis of variance (ANOVA) with two *a priori* contrasts. The first contrast compared the baseline condition with the composite of the more-greed and the less-fear conditions; the second contrast compared the more-greed and the less-fear conditions.

As shown in Figure 3, the analyses revealed that, compared with the baseline condition (M = 6.85, SD = 1.87), participants were less likely to volunteer in the composite of the more-greed and the less-fear conditions (M = 6.24, SD = 2.26), F (1, 316) = 33.47, $p < .001$, $\eta_p^2 = .096$, d = .30. Next, we found that participants were less likely to volunteer in the more-greed condition (M = 6.04, SD = 2.41) than in the less-fear condition (M = 6.44, SD = 2.09), F (1, 316) = 9.40, p = .002, $\eta_p^2 = .029$, d = .17. Thus, there was empirical support for the greed-dominance hypothesis, while the data were also partially consistent with the Nash hypothesis.

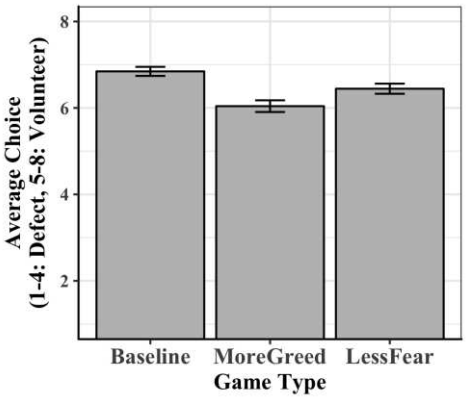

Figure 3. Study 1. Mean rating of the likelihood of volunteering in each game. Error bars represent one standard error of the mean.

Next, we dichotomized the data such that ratings between 1 and 4 to 0 were coded as intended defection and ratings between 5 and 8 to 1 were coded as intended volunteering. Table 2 shows the evidence for the greed-dominance hypothesis in that the probability of volunteering is nominally the lowest in the more-greed condition. In addition, there is a considerable discrepancy between the overall probability of volunteering and game-theoretic benchmarks (Nash). This discrepancy exceeds earlier reports of over-volunteering (Krueger, Ullrich, & Chen, 2016; Krueger, et al., in press).

Table 2. A comparison between the probability of volunteering based on the Nash equilibrium and the actual proportions of volunteering in Study 1.

	Nash	Data
Baseline	0.5	0.87
More Greed	0.33	0.74
Less Fear	0.33	0.82

Study 2

The canonical approach used in Study 1 conflated the motives of the two players. In Study 2, we modified the experimental design by varying the T (greed) or the P (fear) payoffs for one player at a time. While the baseline game retained its symmetrical structure, the more-greed and the less-fear games were separated into a self-varied version (i.e., only Player 1's payoff was modified) and an other-varied version (i.e., only Player 2's payoff was modified).

With this modification, we could evaluate 4 distinct predictions about respondents' readiness to volunteer. First, the Nash hypothesis predicts that respondents will be less likely to volunteer when the other player's T or P payoffs are increased. Variations in the player's own payoffs should have no effect.

Second, the "strength" hypothesis, which is derived from Diekmann's (1993) elaboration of Schelling's (1960) theory of strategic conflict, sharply conflicts with the Nash hypothesis. Using Diekmann's ratio of T/(T-R) to index a player's "strength" (i.e., tolerance of sacrifice), this hypothesis states that in the self-varied versions of the more-greed and the less-fear conditions, the strength of Player 2 (ratio = 2.0) is stronger than that of Player 1 (ratio = 1.5). Therefore, respondents (who are Player 1) should be less likely to volunteer in these conditions than in the baseline condition, where both players are equally strong. Conversely, respondents should be more likely to volunteer in the more-greed and the less-fear conditions than in the baseline condition, when the other player's payoffs are varied. This prediction is the opposite of the prediction derived from the Nash hypothesis.

Third, the egocentrism hypothesis (Evans & Krueger, 2011; Krueger, 2014) foresees no differences in the likelihood of volunteering when the other player's payoffs are varied. However, if respondents are, as predicted, selectively sensitive to variations in their own potential payoffs, the likelihood of volunteering should be lower in the more-greed and in the less-fear condition than in the baseline condition.

Fourth, the greed-dominance hypothesis predicts that an increase in the T payoff has a stronger impact than an increase in the P payoff. The pure version of this hypothesis is that this difference should only be seen when the respondent's own payoffs vary. The greed-dominance hypothesis is, in other words, a subset of the egocentrism hypothesis. Table 3 displays the predictions of the 4 hypotheses schematically.

Table 3. Predicted results in Study 2. B stands for Baseline; LF stands for Less Fear; MG stands for MG.

	The Likelihood of Volunteering	
	Self-varied	Other-varied
Nash	B = LF = MG	B > LF = MG
Strength	B > LF = MG	B < LF = MG
Egocentrism	B > LF = MG	B = LF = MG
Egocentrism w/ Greed-dominance	B > LF > MG	B = LF = MG

Method

Participants Three hundred and fifty-one participants took part in Study 2 via MTurk for a flat payment of $0.75 each. Of these, 36 participants failed all 3 comprehension check questions and 1 participant did not complete the task. We analyzed the data of the remaining 314 participants (N_{male} = 174, N_{female} = 138, N_{other} = 2, M_{age} = 35.19, SD_{age} = 10.62). The experimental design was a 3 (Game Type: baseline vs. more greed vs. less fear) by 2 (Asymmetry Target: self-varied vs. other-varied) within-subjects design.

Materials The baseline game, which serves as a frame of reference, was the same as in Study 1. In the self-varied version of the more-greed game, the payoff T for Player 1 was raised by $10, while Player 2's payoff T was identical to the payoff T in the baseline game. In the self-varied version of the less-fear game, the payoff P for Player 1 was increased by $5 but Player 2's payoff P remained to be $10. These changes resulted in identical adjustments in the game-theoretic benchmarks (Nash). The other-varied versions of the more-greed and the less-fear games were made in the same way, except that it was the payoff for Player 2 that was modified (Figure 4).

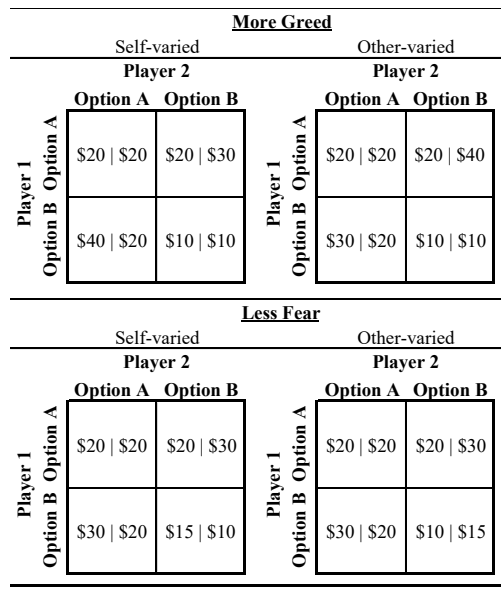

Figure 4. Study 2. Asymmetric VoD games (Player 1 = Participants).

Procedure Participants first received the instructions on how to play the games and then viewed a sample payoff matrix before responding to 3 comprehension check questions. Participants had to select the cases in which their payoffs would be the highest and lowest, and the other player's payoffs would be the highest.

In the experiment proper, participants were presented with the same baseline game twice and the more-greed and the less-fear games in both versions of Target Asymmetry (a total of 6 games). They were instructed to make their decisions for every game independent from the other games. The presentation order of the self-varied versions of the more-greed and the less-fear games and the other-varied versions of the more-greed and the less-fear games was counterbalanced across participants. Within each type of Asymmetry Target (self-varied vs. other-varied), the presentation order of the more-greed and the less-fear games was also counterbalanced. However, the first game was always the baseline game. As the fourth game, right before switching to one of the two versions of Asymmetry Target games, we presented the baseline game again to reinstate the same reference before they would be introduced to the games with a new target of asymmetry. An example presentation order of the 6 games is as follows: 1st baseline,

2nd more-greed in the self-varied version, 3rd less-fear in the self-varied version, 4th baseline, 5th more-greed in the other-varied version, 6th less-fear in the other-varied version.

For each game, participants were shown the payoff matrix and prompted to indicate, between Option A and Option B, which option they would choose, using again a bipolar 8-point rating scale of *Very likely to choose Option A* (1) - *A bit likely to choose Option A* (4) - *A bit likely to choose Option B* (5) - *Very likely to choose Option B* (8).

Results and Discussion

We subtracted each rating from 9 before submitting the data to one-way (3 Game Type: baseline vs. more greed vs. less fear) repeated measures ANOVAs, one for the self-varied versions of the games and another for the other-varied versions. As in Study 1, we specified two contrasts for Game Type. One contrast compared the baseline condition with the composite of the more-greed and the less-fear conditions; the other contrast compared the more-greed condition with the less-fear condition. We also ascertained that there was no significant difference between the first baseline game and the second baseline game (p = .24). We therefore used the averaged responses in the two baseline games to represent the baseline.

In the self-varied versions of the game, we found that, compared to the baseline condition (M = 5.57, SD = 2.71), the rated likelihood to volunteer was lower in the composite of the more-greed and the less-fear conditions (M = 4.82, SD = 2.78), F (1, 313) = 48.86, p < .001, η_p^2 = .14, d = .35. Although the likelihood of volunteering was nominally lower in the more-greed condition (M = 4.69, SD = 2.73) than the less-fear condition (M = 4.95, SD = 2.84), this difference was not statistically significant. Thus, the results from the self-varied versions of the VoD games were consistent with the strength hypothesis and the egocentrism hypothesis, but not with the Nash hypothesis.

Analyses of the other-varied versions of the games revealed an additional support for the egocentrism theory. Here we found that none of the comparisons were statistically significant. As shown in the right panel of Figure 5, when the more-greed and the less-fear manipulation was applied to the other player's payoff, participants distinguished neither the baseline condition (M = 5.57, SD = 2.71) from the composite of the more-greed and the less-fear conditions (M = 5.54, SD = 2.74) nor the more-greed (M = 5.50, SD = 2.71) from the less-fear conditions (M = 5.58, SD = 2.69). This pattern is strikingly inconsistent with the Nash hypothesis.

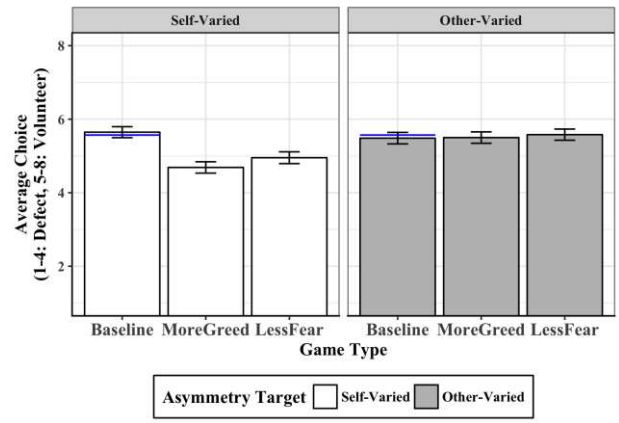

Figure 5. Study 2. Mean rating of the likelihood of volunteering in each game. Error bars represent one standard error of the mean. The blue lines represent the average of the two baseline conditions.

In the next step, we calculated the proportions of volunteering after dichotomizing the ratings. Table 4 shows that there was again evidence for over-volunteering. However, in the self-varied versions of the more-greed and the less-fear conditions, the Nash-based probabilities and the actual proportions of volunteering are similar. This may suggest that the Nash hypothesis has a certain degree of predictive power. But, at the broader level, the Nash-based predictions were still unsupported because the proportions of volunteering were higher in the other-varied versions of the games compared to the self-varied versions of the games. Considering that the overall proportions of volunteering in all the conditions went down in Study 2 compared to those in Study 1, the close match between the Nash-based theoretical probabilities and the actual proportions in the self-varied versions of the games in Study 2 may be the artifact of the decreased volunteering in all the conditions. Yet, it is unclear why the proportions of volunteering were less in Study 2 than in Study 1.

Table 4. A comparison between the probability of volunteering based on the Nash equilibrium and the actual proportions of volunteering in Study 2.

		Nash	Data
Self-varied	Baseline	0.5	0.66
	More Greed	0.5	0.5
	Less Fear	0.5	0.55
Other-varied	More Greed	0.33	0.65
	Less Fear	0.33	0.68

General Discussion

The main purpose of this research was to investigate the relative impact of two potential motives concerning volunteering versus defecting. We operationalized 'greed' as the difference between the payoff for unilateral defection

(T) and the payoff for volunteering (R). We operationalized 'fear' as the differences between R and the payoff for mutual defection (P). To equalize the two with regard to their implications for a change in the Nash equilibrium, the change in T for the increase in greed had to be numerically twice as large as the change in P for the reduction of fear. Participants' choices may have been inordinately affected by these differences in nominal values, which would represent the operation of a cognitive-perceptual factor independent of the motivational implication of these differences. This possibility remains to be investigated.

To review: Study 1 supported the greed-dominance hypothesis in that the likelihood of volunteering decreased more with an increase in the T payoff than with an increase in the P payoff. This result is inconsistent with game-theoretic predictions informed by the Nash equilibrium.

Study 2 yielded weaker support for the greed-dominance hypothesis, but again shed doubt on the game-theoretic Nash hypothesis. The critical design feature of Study 2 was the separation – and hence unconfounding – of differences in the participants' own payoffs and differences in the other players' payoffs. The calculation of the Nash equilibrium strategies from one player's point of view involves the other player's payoffs because the definitional feature of the Nash equilibrium is that it holds the other player in a state of indifference between available strategies. Overall, we found a strong tendency for over-volunteering relative to game-theoretic benchmarks. The over-volunteering effect may have been exacerbated by the hypothetical nature of the game, but it deserves note that the available strategic options were labeled neutrally (Options A and B).

In contrast to game-theoretic rationale, participants were sensitive to differences in their own potential payoffs, while ignoring the other player's payoffs. This pattern is in line with recent theory and research on the use of egocentric heuristics in strategic interaction (Krueger, 2014). The neglect of others' payoffs also ran counter to the Schellingian "strength" hypothesis, according to which any payoff change is relevant for the assessment of differences in players' ability to tolerate a loss or forego a gain.

A puzzle remains: How is it that ordinary people and research participants readily perceive the VoD in moral terms, identifying the decision to volunteer with "the right choice" (Heck & Krueger, 2017), while at the same time bringing a pronounced egocentric orientation to the judgment task? Related research on interpersonal trust (Evans & Krueger, 2011) and the prisoner's dilemma (Krueger, 2014) points in a similar direction. We speculate that what we have here is a pseudo-problem, namely the idea that prosocial behavior and outcomes demand prosocial mental processes. Conceptually, the two are separable, thereby allowing the empirical patterns we observe. The optimistic interpretation is that the social good may be achieved without necessarily having to turn individuals against their own material interests.

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